

# SUBJECT INDEX

- Acanthocytosis 211
- Actin, red cell membranes 172, 177
- Activated oxygen, production by leucocytes 452
- Acute intermittent porphyria
  - diet and nutrition 63
  - epidemiology 39-48
  - haem arginate treatment 63
  - haematin treatment 64
  - hypertension in 47
  - isolation of mutant enzyme 128
  - LHRH analogue treatment 65
  - model for 53
  - <sup>31</sup>P MRS 56
  - porphobilinogen deaminase in erythrocytes 32, 33
  - restriction fragment length polymorphism 127, 128, 130
- Adenosine triphosphate, phospholipid asymmetry in red cell membranes 167
- S-Adenosyl-L-methionine, effect on erythropoietic protoporphyria 89
- Adenovirus type 2 *Ela* gene 273
- Adhesion proteins 441
- Adrenaline, bronchoconstriction 370
- Adrenergic regulation of airways 368
- $\alpha$ -Adrenoceptors
  - airways 378
  - role in effect of haem biosynthetic intermediates 53
- $\beta$ -Adrenoceptors
  - airways 373
  - function in asthma 376
- Afferent nerves, airways 356
- Airway disease 351-423
  - adrenergic mechanisms 368
  - afferent nerves 356
  - autonomic abnormalities 355
  - axon reflexes 389
  - cholinergic mechanisms 359
  - neuropeptides 382
  - non-adrenergic mechanisms 381
  - non-cholinergic mechanisms 386
- Alagille syndrome 77
- Albumin, binding in hepatocytes 30
- Alcoholism, effect on haem metabolism 29
- Alcohol and porphyria 118
- Alcohols, induction of cytochrome P-450 121
- Allylisopropylacetamide, effect on hepatic porphyrin metabolism 12
- Alveolar macrophages 437
  - role in asthma 480
  - role in fibrotic disease 467
  - role in sarcoidosis 473
- Alveoli 428
- Alveolitis 465
- 5-Aminolevulinic acid
  - <sup>13</sup>C NMR 143
  - pharmacological effects 50
  - porphyrin biosynthesis form in breast carcinoma 105
  - effect of prazosin on activity of 53
  - effect on rat jejunum 53, 55
  - synthesis in *Cyanidium caldarium*, gabaculine inhibition 133
  - synthesis in *E. coli* 135
  - synthesis in plants 134
  - effect on ventral root activity in spinal cord 53
- Aminolevulinic acid dehydratase
  - effect of alcoholism 29
  - in diabetic mice 28, 29
  - in erythroleukemia cells, effect of dimethyl sulphoxide 97
  - lead and metal ion chelators are slow binding inhibitors 27
  - in *Mucor rouxii* 28
  - porphyria 22
  - in *Rhizobium japonicum* 135
  - effect of valproic acid 117
- Aminolevulinic acid synthase
  - in chicken embryo 141
  - cDNA clones 128
  - control of synthesis 117, 120, 121
  - in haem deficient erythroblasts 98
  - in hepatoma cells 140
  - induction by synthetic oestrogens 121
  - in *Mucor rouxii* 28
  - porphyria 21
- Amphiboles 328, 332, 333
- Anion transporter protein 177
- Ankyrin 173, 176, 181
  - spectrin interaction 195
  - spherocytosis 206
- Arsenic, effect on coproporphyrinogen oxidation in liver and kidney 25
- Asbestos 325-345
  - chemistry and composition 327
  - epidemiology of related disease 333
  - fibre respirability and retention 331
  - mechanisms of pathogenesis 335, 465
- Asthma
  - $\alpha$ -adrenoceptor function 379
  - $\beta$ -adrenoceptor function 376
  - autonomic abnormalities 355
  - axon reflexes 389
  - effect of beta-blockers 371
  - catecholamines 371
  - cholinergic mechanisms 365
  - role of leucocytes 475
- Athymic mice, tissue porphyrins 150
- Autonomic regulation of airways 353
- Axon reflexes, asthma 389
- Azurophil granules 436

- Basic protein, leucocytes 454  
   role in asthma 477  
 Basophils 438  
   role in asthma 478  
 Beta-blockers, airway function 371  
 Bilirubin metabolism 153-160  
   genetic defects 153  
   role of lipid peroxidation 155  
 Bilirubin-IX, synthesis 159  
 Bilirubin oxidase, in liver microsomes 158  
 Biliverdin reductase 158  
 Bleomycin, lung injury 465, 467  
 Bone marrow, cells derived from 432  
 Breast cancer, porphyrin biosynthesis 105  
 Bronchoconstriction  
   adrenergic mechanisms 368  
   afferent nerves 357  
   cholinergic mechanisms 359  
 Buserelin 66
- Calcitonin gene-related peptide, in  
   airways 389  
 Calmodulin, regulation of red cell membrane  
   protein interactions 174  
 Cancer  
   lung, mineral fibre induced 334, 339, 341  
   porphyrins, photochemotherapy 99-111  
 Carbon monoxide, haem oxygenase  
   measurement 35  
 Catecholamines, asthma 371  
 Ceramic fibres 331  
 C-fibres, airways 358  
 Charcoal, effect on cutaneous  
   photosensitivity 62  
 Chelation therapy, porphyria 65  
 Chemotaxis, leucocytes 448  
 Chester porphyria 46  
 Chicken embryo, 5-aminolevulinic acid synthase  
   production 141  
 Chlorophyll, destruction in stressed plants,  
   role of iron 132  
 Chloroquine, porphyria treatment 73, 74  
 Cholecystokinin octapeptide, in airways 392  
 Cholesterol, red cell membrane 165  
 Cholinergic mechanisms in airways 359  
 Chromosomes, mineral fibre induced  
   aberrations 339  
 Chronic obstructive airways disease 357, 367  
 Chrysotile 327, 332, 333, 335, 339  
 Cigarette smoke  
   asbestos interaction 341  
   emphysema 462  
   irritant receptors 357  
 Clara cells, stimulation by beta-agonists 373  
 Cobalt-protoporphyrin 24  
 Collagenases, in leucocytes 454  
 Collagens, lung 430  
 Colony stimulating factors 434  
 Committee on Review of  
   Porphyrinogenicity 113  
 Congenital dyserythropoietic anaemias 213  
 Congenital erythropoietic porphyria 86, 87
- Coproporphyrin 11  
   trace metal-induced 25  
 Coproporphyrin  
   abnormalities in Alagille syndrome 77  
   photosensitization by 109  
   secretion after chloroquine treatment 74  
 Coproporphyrinogen oxidase, in liver 25  
 Cough receptors 357  
 Crigler-Najjar syndromes 153, 155, 156  
 Crocidolite 334  
 Cryptogenic fibrosing alveolitis 465  
 Cyanidium caldarium  
   gabaculine inhibition of 5-aminolevulinic acid  
   synthesis 133  
   haem oxygenase in 133, 159  
 Cyclophosphamide, porphyrinogenic  
   action 122  
 Cystic fibrosis, autonomic abnormalities 356  
 Cytoadhesins 445  
 Cytochrome P-450  
   control of hepatic 5-aminolevulinic acid  
   synthase 117, 120, 121  
   induction by alcohols 121  
 Cytochrome P-450d, role in uroporphyrinogen  
   oxidation 115  
 Cytogenetics 258  
 Cytokines, leucocytes 456  
 Czechoslovakia, hepatic porphyrias in 42
- Deoxyribonucleic acid, effect of asbestos 339  
 Deoxyribonucleic acid, transfection and  
   metastasis  
   *Ela* 273  
   genomic DNA 271  
   MHC genes 272  
   oncogenes 259  
 Desferrioxamine, porphyria cutanea tarda 72  
 Diabetes, haem biosynthesis 28, 29  
 Diapedesis, leucocytes 448  
 Diet, porphyria 63  
 Differential cDNA screening, metastasis 275  
 Dihydropyridines, porphyrinogenicity 116  
 2,3-Dimercaptopropane-1-sulphonate, lead  
   poisoning therapy 27  
 Dimethyl sulfoxide  
   induction of 5-aminolevulinic acid synthase  
   in hepatoma cells 140  
   effect on mRNA and 5-aminolevulinic  
   acid dehydratase in erythroleukemia  
   cells 97  
 Diprivan, porphyrinogenesis 119
- Ela*, metastasis 273  
 EDTA  
   prophobilinogen synthase inhibition 27  
   porphyria therapy 65  
 Elastases, leucocytes 453  
   emphysema 462  
 Elastin, lung 430  
 Elastin adhesion proteins 447

- ELISA, porphobilinogen deaminase in erythrocytes 32
- Elliptocytosis 185  
 epidemiology 200  
 malaria 201  
 protein 4.1 197, 199  
 sialoglycoproteins 198  
 spectrin abnormality 188
- Emphysema, role of leucocytes 460
- Endothelial leucocyte adhesion molecule-1 446
- Eosinophils 436  
 basic proteins 454  
 role in asthma 475  
 role in fibrotic lung disease 471
- Erionite 328, 334, 340
- Erythrohepatic protoporphyria 90
- Erythropoietic haem synthesis 91-98
- Erythropoietic porphyrias 83-90  
 S-adenosyl-L-methionine 89  
 congenital 86, 87  
 haematin in 86  
 haem synthetase deficiency 85  
 inactivation of spleen deaminase by porphyrin 87  
 protoporphyria 88
- Erythropoietic protoporphyria 11  
 bile porphyrin and porphyrinogen levels 54
- Erythropoietin, treatment for porphyria cutanea tarda 73
- Escherichia coli*  
 5-aminolevulinic acid synthesis in 135  
 porphobilinogen deaminase in 142
- Ferric nitrilotriacetate 72
- Ferritin, in serum in porphyria cutanea tarda 80
- Fibronectin, lung 430
- Fibrosis, mineral fibre induced 333, 335
- Fibrotic lung disease 465  
 role of macrophages 467
- Finland, porphyria in 44  
 fos-oncogene 269
- Franklin fibre 338
- Fybex 331
- Gabaculine, inhibition of 5-aminolevulinic acid synthesis in *Cyanidium caldarium* 133
- Galanin, airways 391
- Gamma interferon 457
- Ganglia, airways 364
- Gastrin-releasing peptide, airways 392
- Gelatinase, in neutrophils 454
- Gene amplification 254
- Genetic instability, tumours 252
- Genomic DNA 271
- Gerbich negative individuals 199
- $\beta$ -Globulin gene 126
- Glucose, effect on haem metabolism 28
- Glycine, incorporation into porphyrin ring 13
- Glycosphingolipids, in red cell membrane 165
- Goldberg, A. 3
- Granule membrane protein-140 446
- Granulocyte colony stimulating factor 434
- Granulocyte-macrophage colony stimulating factor 434
- Griseofulvin, induced protoporphyria 123
- Growth factors, in leucocytes 456
- Gunther's disease 87
- Haem  
 alcoholism and metabolism of 29  
 biosynthesis 21, 125-130, 137-144  
 cell culture synthesis 137-144  
 deficiency 50  
 erythropoietic synthesis 91-98  
 metabolism in diabetic mice 28, 29  
 metabolism in liver 12  
 molecular biology 125-130  
 regulation of gene expression 23  
 effect of valproic acid on synthesis 117
- Haem arginate 60, 61, 63
- Haematin  
 effect on erythropoietic porphyria 86  
 porphyria treatment 64
- Haematoporphyrin derivative 99, 104, 106, 108, 109
- Haemin, effect of prazosin on pharmacological activity 53
- Haemodialysis, porphyria cutanea tarda 73, 77
- Haemoglobinopathies 215
- Haemopexin 23  
 binding in hepatocytes 30
- Haem oxygenase 23  
 in *Cyanidium caldarium* 133, 159  
 measured by CO production 35  
 regulation by metalloporphyrins 24  
 sensitivity to synthetic metalloporphyrins 160
- Haem precursors, inhibition of porphobilinogen deaminases 51
- Haem synthetase, genetics of deficiency in erythropoietic protoporphyria 85  
 protoporphyria 85
- Hardarian gland, role in porphyrin synthesis 145-152
- Hepatocytes, porphyrin synthesis 139
- Hepatoma cells  
 5-aminolevulinic acid synthase in 140  
 porphyrin synthesis in 139
- Hering-Breuer reflex 357
- Hexachlorobenzene  
 induced Turkish porphyria 11, 13  
 overload 78  
 transplacental and mammary absorption 81
- Histamine  
 asthma 479  
 irritant receptors 357  
 leucocytes 455
- HLA types, porphyria cutanea tarda 76



- HPLC, plasma porphyrins 33, 35  
*H-ras*-gene, metastasis 260, 264  
 Hypertension, acute intermittent porphyria 47
- Inflammation  
   asthma 475  
   integrins 444  
   interleukins 457  
   lung, role of leucocytes 444, 451  
 Insulin-like growth factor-1 458  
 Interferons 457  
 Integrins 441  
 Interleukin-1 456  
 Interleukin-2 457  
 Interleukin-3 434  
 Interleukin-5 434  
 Interleukin-8 457  
 Interstitial lung disease, role of leucocytes 464  
 Intracellular adhesion molecule-1 443, 446  
 Iron  
   genetic expression of haem metabolism 96  
   porphyria cutanea tarda 67, 72, 74, 76, 77, 82  
   role in chlorophyll destruction in stressed plants 132  
   uroporphyrin 122  
   utilization in beta-thalassaemia 94  
 Iron deficiency anaemia, zinc protoporphyrin formation 26  
 Irritant receptors 357
- Kevlar 331  
 Kidney, trace-metal induced coproporphyrin 25
- Laminin, lung 430  
 Leach phenotype 199  
 Lead  
   prophobilinogen synthase inhibition 27  
   effect on protoporphyrin IX 31  
 Lead poisoning, therapy  
   with 2,3-dimercaptopropane-1-sulphonate 27  
 Leucocytes 425-526  
   chemotaxis and diapedesis 448  
   integrins 443  
   mechanisms of adherence 441  
   origin of cells 432  
   products of 452  
   role in pulmonary disease 460  
 LHRH analogues, porphyria treatment 65, 66  
 Lipid peroxidation, role in bilirubin metabolism 155  
 Liver, role in erythropoietic protoporphyrin 85  
 Low density lipoproteins, role in porphyrin uptake 101
- Lung  
    $\alpha$ -adrenoceptors 378  
    $\beta$ -adrenoceptors 373  
   architecture 428  
   leucocytes and disease 460  
   mechanisms of adherence 441  
   mineral fibre related disease 333, 335  
   mineral fibre retention 331  
 Lymphocyte-associated molecule-1 446  
 Lymphocyte homing receptor 446  
 Lymphocytes 439  
   cell adhesion receptors 446  
   role in asthma 479  
   role in fibrotic lung disease 470  
   role in sarcoidosis 471  
 Lymphoid cells 435
- Macrophage colony stimulating factor 434  
 Macrophages 437  
   collagenases in 454  
   emphysema 464  
   role in asthma 480  
   role in fibrotic lung disease 335, 467  
   role in sarcoidosis 473  
 Magnetic Resonance Spectroscopy,  $^{31}\text{P}$ , porphyria 56  
 Major histocompatibility complex genes 272  
 Malaria, elliptocytosis 201  
 Man-made mineral fibres 331, 335  
 Mast cells 434, 438  
   role in asthma 478  
 McLeod phenotype 212  
 Menstrual cycle  
   prophobilinogen deaminase in red blood cells 52  
   porphyria 59, 66  
 Mercury, effect on coproporphyrinogen oxidation in liver and kidney 25  
 Mesothelioma, asbestos induced 333, 337  
 Metalloporphyrins  
   control of haem metabolism 24  
   GCMS 19  
   haem oxygenase inhibition 35, 160  
 Metalloporphyrin 107  
 Metastasis 243-324  
   assays for 245  
   cytogenetics 258  
   differential cDNA screening 275  
   DNA transfection 259  
   genetic instability 252  
   genetic models 254  
   genomic DNA 271  
   methylation 282  
   oncogenes 259  
   RNA expression 275  
   somatic cell hybridization 256  
   tumour heterogeneity 247  
 Metastogenes 256  
 Methylation, metastasis 282  
 Mineral fibres, pathogenic mechanisms 325-349  
 Monocytes 437

- Mononuclear leucocytes 432  
*Mucor rouxii*, 5-aminolevulinic acid synthetase  
 and 5-aminolevulinic acid dehydratase  
 in 28  
 Mucus secretion, airways 361  
 Muscarinic receptors, airways 362  
 Mutation, metastatic variants 253  
 Myeloid cells 432  
 Myosin, red cell membranes 173
- NADPH oxidase, induction 132  
 Nedocromil sodium 358  
 Neuroendocrine cells, airways 359  
 Neurokinin A, effect on airways 387  
 Neuropeptide Y, in airways 391  
 Neutral endopeptidase, in airways 388  
 Neutrophil-activating peptide-1 457  
 Neutrophils 435  
   collagenases 454  
   elastase in 453  
   integrins and inflammation 444, 451  
   role in asthma 478  
   role in emphysema 462  
   role in fibrotic lung disease 468  
   role in sarcoidosis 475  
 Nicotinic cholinergic receptors, airways 362  
 NIH3T3 cells, oncogenes 260  
 Non-adrenergic inhibitory nerves,  
   airways 381  
 Non-cholinergic excitatory nerves,  
   airways 386  
 Noradrenaline, effect on cholinergic  
   transmission in airways 361  
 Nutrition, porphyria 63
- Oestrogens, 5-aminolevulinate synthase  
   induction 121  
 Oncogenes, metastasis 259  
 Oxidant-generating systems, leucocytes 452  
 Oxygen free radicals, asbestos stimulated  
   production 340
- Parasympathetic airway ganglia 364  
 Peptide histidine isoleucine, in airways 385  
 Phagocytes 432, 435  
 1,10-Phenanthroline, uroporphobilinogen synthase  
   inhibition 27  
 Phlebotomy 73  
 Phospholipid bilayer, red cell membrane 165  
 Phosphorylation, red cell membrane  
   proteins 173  
 Photochemotherapy 99-111  
 Photofrin II 101, 102  
 Photosensitivity 7, 11, 100, 104  
   Alagille syndrome 77  
   animal model 105  
   effect of oral activated charcoal 62  
   porphyrins 109  
   purpurin and metallopurpurin  
     derivatives 107
- Phototherapy, porphyrins 17  
 Platelet-activating factor  
   asthma 477  
   leucocytes 455  
 Platelet-derived growth factor 458  
 Platelets 439  
   role in asthma 480  
 Poikilocytosis 186, 193  
 Poland, porphyria in 43  
 Polymorphonuclear leucocytes 432  
 Polyploidy, mineral fibre induced 340  
 Porphobilinogen 7, 8, 14  
 Porphobilinogenase, in spleen in congenital  
   erythropoietic porphyria 87  
 Porphobilinogen deaminase  
   active site of 142  
   dipyrromethane cofactor 143  
   ELISA 32  
   in erythrocytes, errors in measurement 33  
   in erythrocytes, Finland 44  
   independent and sequential functioning 30  
   inhibition by haem precursors 51  
   effect of sex hormones 52  
   sulphamerazine inhibition of 144  
 Porphobilinogen deaminase gene 125, 126  
 Porphobilinogen synthase, <sup>13</sup>C NMR 142  
 Porphyria  
   epidemiology 39-48  
   history 3  
   pathogenesis 49-57  
   phases of 44  
   therapy 59-66, 67-82  
 Porphyria cutanea tarda 67-82  
   desferoxamine 72  
   epidemiology 39-48  
   familial versus sporadic 71, 81  
   haemodialysis associated 73  
   HLA types 76  
   hexachlorobenzene 78, 81  
   inheritance and prevalence 75  
   iron 67, 72, 74, 76, 82  
   mitochondrial function 80  
   serum ferritin 80  
   serum porphyrin 78, 157  
   trace elements 76  
   urinary porphyrin 157  
   UV-A radiation 80  
   zinc 79  
 Porphyria variegata 11, 12  
 Porphyrinogen, in bile 54  
 Porphyrinogenicity of drugs 113-123  
 Porphyrins  
   in bile 54  
   biochemistry 21-37  
   cancer, photochemotherapy 17, 99-111  
   chemistry 17  
   early synthesis 13  
   evaluation of analytical methods 36  
   GCMS 19  
   Harderian gland 145-152  
   HPLC 33, 35  
   plant and bacterial systems 131-135  
   radiolabelled 110

- synthesis in cultured cells 139
- synthesis in liver, drug-related 12
- synthesis, recent progress 19
- tumour phototherapy 17, 99-111
- Porphyrin synthesis genes, cloning and expression in *E. coli* 129
- Potassium octatitanate 340
- Prazosin, inhibition of effects of haem biosynthetic intermediates 53
- Pregnancy
  - porphobilinogen deaminase in red blood cells 52
  - porphyrin synthesis in Harderian gland 151
- Propendyosins and the Stokvis reaction 18
- Propofol 119
- Propranolol, bronchoconstriction 371
- Protein 4.1, red cell membranes 172, 174, 175, 176, 181
  - elliptocytosis 197
  - sialoglycoprotein interaction 199
  - variants 199
- Protein 4.9, red cell membranes 172
- $\alpha$ -1-Proteinase inhibitor, emphysema 460, 463
- Proteoglycans, lung 430
- Protoporphyrin
  - ferochelatase in cattle 88
  - griseofulvin induced 123
- Protoporphyrin
  - in erythrocytes, effect of valproic acid 117
  - in liver 85
  - photodynamic transfer from erythrocytes to cells in culture 88
  - photosensitization by 109
- Protoporphyrin IX
  - measurement 34
  - effect of prazosin on pharmacological activity 53
  - in workers exposed to lead 31
- Protoporphyrinogen oxidase 24
- Protoporphyrinogen IX oxide 45
- Pulmonary fibrosis, asbestos induced 333, 335, 465
- Pulmonary innervation 354
- Purpurin 107, 132
- Pyropoikilocytosis 190, 193
- Rapidly adapting receptors, airways 357
- Rat embryo fibroblasts, *H-ras* oncogene 264
- Red cell skeleton, genetic disorders 161-241
  - acanthocytosis 211
  - anion transporter protein 177
  - composition 167
  - congenital dyserythropoietic anaemias 213
  - haemoglobinopathies 215
  - hereditary elliptocytosis 185
  - hereditary spherocytosis 203
  - protein 4.1 172
  - sialoglycoproteins 179
  - spectrin  $\alpha$ - and  $\beta$ -chains 168
  - stomatocytosis 209
- Respiratory tract
  - inhalation and retention of mineral fibres 331
  - innervation 353
  - leucocytes and disorders of 425-526
- Restriction fragment length polymorphism, acute intermittent porphyria 127, 128, 130
- Rhesus proteins, stomatocytosis 210
- Rhizobium japonicum*, 5-aminolevulinic acid dehydratase in 135
- Ribonucleic acid expression, metastasis 275
- mRibonucleic acids, 5-aminolevulinic acid synthase and cytochrome P-450 117, 120
- Rimington, C. 3
- Saccharomyces cerevisiae*, porphobilinogen synthase purification 129
- Sarcoidosis, role of leucocytes 471
- Sex hormones, porphyria 52, 59
- Sialoglycoproteins, red cell membranes 179
  - elliptocytosis 198
  - variants 212
- Sickle cell disease 215
- Siderblastic anaemias, 5-aminolevulinic acid synthase 96
- Silicates 327
- Silicosis 336
- Slowly adapting receptors, airways 357
- Somatic cell hybridization 256
- Somatomedin C 458
- South Africa, porphyria 43
- Spain, porphyria 48
- Spectrin, red cell membranes 168, 174, 176, 181
  - ankyrin-band 3 articulation defects 195
  - elliptocytosis 188
  - shortened  $\beta$ -chain variants 194
  - spherocytosis 205
- Spectrin  $\alpha$ - and  $\beta$ - genes, red cell membrane 170
- Spherocytosis 203
- Spinal cord, effect of 5-aminolevulinic acid 53
- Spironolactone, induction of hepatic porphyria 116
- Spleen, porphobilinogenase in 87
- Stanton fibres 337, 338
- Stokvis, B.J. 6
- Stokvis reaction 18
- Stomatocytosis 209
- Streptozotocin diabetic mice, haem biosynthesis in 28, 29
- Stretch receptors 357
- Substance P, in airways 358, 386
- Succinylacetone 118
- Sulphamerazine, inhibition of porphobilinogen deaminase 144
- Sulphaemoglobins 19
- Superoxide, uroporphyrinogen oxidation 74



- Swedish Porphyric Association 64  
Sympathetic innervation, airways 369
- Tachykinins, in airways 387  
Talc 339  
 $\beta$ -Thalassaemia 202, 216  
    haem biosynthesis, iron utilization 94  
Tin-protoporphyrin 23  
    effect on haem oxygenase 36  
    porphyrin therapy 61  
T lymphocytes 439  
Tobacco smoke, asbestos interaction 341  
Trace elements, cutaneous porphyrias 76  
Transferrin, binding in hepatocytes 30  
Transforming growth factor  $\beta$  458  
Transmembrane proteins, red cells 177  
Tropomyosin 173  
Tumour cells, metastasis 245  
Tumour heterogeneity 247  
Tumour necrosis factor, in leucocytes 456  
Tumour suppressor genes 256  
Turkish porphyria 11, 13
- Uridine diphosphate glucuronyl  
    transferase 153  
    genetic deficiency 156  
Uroporphyrin, role of iron 122  
Uroporphyrin  
    detection in malignant cells 110  
    photosensitization by 109  
Uroporphyrinogens 8  
    oxidation by methylcholanthrene-induced  
        cytochrome P-450 115  
Uroporphyrinogen III cosynthase 30  
Uroporphyrinogen decarboxylase  
    in erythroleukemia cells, effect of dimethyl  
        sulphoxide 97
- porphyria cutanea tarda 72, 74, 76, 77, 79  
UV-A irradiation, porphyria cutanea  
    tarda 80
- Vagus nerve, bronchoconstriction 359  
Valproic acid, effect on haem  
    biosynthesis 117  
    biosynthesis 117  
Variegate porphyria 11, 12, 22  
    bile porphyrin and porphyrinogen levels 54  
    charcoal administration 62  
    epidemiology 39-48  
    haem arginate therapy 61  
    inhibition of porphobilinogen deaminase by  
        haem precursors 51  
    protoporphyrinogen IX oxide in  
        lymphocytes 45  
Vasoactive intestinal peptide, in airways 382  
Very late antigen integrins 445  
Vinblastine, effect on porphyrin  
    synthesis 120  
Vincristine, effect on porphyrin synthesis 120  
Vitronectin receptor 445
- Xerocytosis 209  
X-porphyrins 9
- Yugoslavia, porphyrias in 46
- Zeolites 328  
Zinc, in serum and urine of porphyria  
    patients 79  
Zinc deuteroporphyrin IX,2,4, bis glycol,  
    haem oxygenase inhibition 160  
Zinc protoporphyrin 26